

REMARKS

Status of the Claims

Claims 1, 3, 4, 8-9, 11-15, 36-38, 40-41, 43-47 and 50-55 are currently pending in the present application.

Amendments

Claim 5 has been canceled. Claims 1, 46, 51, 52, 54 and 55 have been amended to specify that the purified purge gas comprising oxygen (O₂) and water has an AMC concentration less than about 1 part per trillion (ppt). This amendment is supported by U.S. Provisional Application No. 60/475,145, for example, at the abstract. Claims 1, 46, 51, 52, 54 and 55 have also been amended to specify that the method includes the step of outgassing AMC from the surface of the contaminated substrate. This amendment is supported by the specification, for example, at pages 6 and 9. Claims 1 and 54 were amended to refer to “the purified purge gas.”

Rejection under 35 U.S.C. § 112, first paragraph

Claims 53 and 55 were rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The Examiner stated that the limitations of the claims constitute new matter not supported by the originally filed specification.

With regard to claim 53, the Examiner stated that the claim is not supported by Example 6 because the claim is directed to outgassing by contacting with a purified purge gas comprising O₂ and water, but Example 6 is directed to XCDA and not molecular oxygen and water, and the XCDA is purified and does not include any teaching of adding water.

With regard to satisfying the written description requirement, the fundamental factual inquiry is “whether the specification conveys with reasonable clarity to those skilled in the art that, as of the filing date sought, applicant was in possession of the invention as now claimed.” MPEP 2613 (I)(B). A person of ordinary skill in the art would have known that XCDA, which stands for eXtreme Clean Dry Air, includes dioxygen, since it is well known that the general composition of air is approximately 21% O₂ and 78% N₂ by volume, with the remainder

including trace amounts of other elements and compounds

(http://www.engineeringtoolbox.com/air-composition-d_212.html, attached hereto).

Regarding water, although Example 6 is directed to XCDA, the provisional specification teaches humidifying XCDA. Specifically, page 14 of U.S. Provisional Application No. 60/475,145, which states “[t]he XCDA may be passed through a bubbler containing UHP water,” and page 15, which states “[i]t is possible to add a bubbler or other wetting device for dry XCDA gas...therefore you dry the XCDA and then remoisturize it with ultrapure H₂O...” Therefore, it would have been clear to a person of ordinary skill in the art that Applicants were in possession of the invention as claimed in claim 53.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

With regard to claim 55, the Examiner stated that the claim is not supported because pages 11-13 fails to teach dehumidifying the purified purge gas comprising oxygen, then adding a controlled amount of water to the dehumidified purge gas. Applicants direct the Examiner’s attention to pages 14 and 15 of U.S. Provisional Application No. 60/475,145, as described immediately above. The priority application teaches drying the XCDA and then remoisturizing it using a bubbler, which provides for the controlled addition of water to the XCDA. Therefore, it would have been clear to a person of ordinary skill in the art that Applicants were in possession of the invention as claimed in claim 55.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Rejection under 35 U.S.C. § 112, second paragraph

Claim 53 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite because it is unclear how the outgassing rate can be expressed as a concentration value of 1ppt or less. The specification refers to outgassing rates in terms of ppt (for example, page 24, line 15 of the present specification and page 9 of Provisional Application No. 60/475,145). As used in the context of the present specification and as would be understood by a person of ordinary skill in the art, the language “outgas from the surface at a rate at or below 1 ppt” means that for every trillion parts of the purge gas provided, one part or less of the organic contaminant outgasses from the surface of the substrate. Thus, parts per trillion is used to refer to both a concentration

and a rate of outgassing. Claims 53 therefore meets the requirements of 35 U.S.C. § 112, second paragraph. Reconsideration and withdrawal of the rejection are respectfully requested.

Rejections under 35 U.S.C. § 103

Claims 1, 3-5, 8-9, 11, 38, 41, 43-47 and 53-54 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,427,703 (hereinafter, "Somekh") in view of U.S. Patent No. 6,610,123 (hereinafter "Wu") and further in view of U.S. Patent No. 6,391,090 (hereinafter, "Alvarez").

The presently claimed invention is directed to outgassing AMC from a surface of the substrate using a purified purge gas comprising oxygen (O₂) and water. Historically, inert purge gases of high purity have been used to purge equipment surfaces of absorbed contaminants. Specifically, conventional wisdom in the art has taught that gases such as ultra high purity (UHP) nitrogen are needed to remove surface impurities (pg. 8, lines 26-28 of the present application). In addition, oxygen and water have long been considered to be impurities that must be removed from equipment surfaces (pg. 11, lines 14-15 of the present application). Therefore, gases containing oxygen and/or water were considered inappropriate for cleaning of equipment components.

The inventors of the present invention made two important discoveries: 1) large amounts of absorbed contaminants can be trapped under equipment surfaces, surprisingly more than originally thought; and 2) contrary to conventional wisdom, the purge gases used in the presently claimed method are capable of desorbing contaminants from equipment surfaces more efficiently than nitrogen. These discoveries are significant, because thorough desorption of contaminants from equipment surfaces can greatly improve product yield and because purge gases comprising oxygen and/or water are safer and less expensive than nitrogen, and they can be produced on site.

The surprising extent to which contaminants are present as absorbed species within equipment and the effectiveness of an oxygen-containing purge gas in effecting their removal by outgassing are demonstrated, for example, in Example 1 and Fig. 9. of the present application. In the example, a contaminated gas containing hydrocarbons was introduced in a wafer chamber to achieve a known level of contamination therein. Two purge gases, UHP nitrogen purge and an oxygen-containing purge gas (extra clean dry air, or XCDA), were used to purge the wafer

chamber and the effectiveness of each was compared. Fig. 9 shows the reduction of hydrocarbon contaminant concentration over time for both purge gases. The oxygen-containing purge gas is represented by line 608, while the nitrogen purge gas is represented by line 606. For both nitrogen and XCDA, the elution times required to achieve a concentration of 10 ppt was greater than six hours (about 6 hours and 20 minutes for XCDA, and about 7 hours for nitrogen), but the theoretical elution time was calculated to be only less than 20 minutes (page 16, lines 20-27). This indicated that most of the contaminants were desorbed contaminants from the surface of the wafer chamber rather than contaminants present in the gas within the chamber. The examples also established that XCDA achieved desorption of the contaminants from the wafer chamber interior surface over a shorter period of time than nitrogen. Similar results are achieved using water-containing purge gases, such as nitrogen and water, and XCDA and water, as demonstrated in Example 5 and Table 1.

In contrast, Somekh discloses carbon deposits from equipment by reacting the carbon deposits to form a volatile gas species. (See Somekh col. 3, lines 13-45.) Somekh explains that repeated exposure of a mask to charged particle beams tends to cause a build-up of carbon on the mask (col. 1, lines 61-67). To eliminate the carbon deposits, Somekh discloses transforming the surface carbon deposits into an oxidized carbon gas, namely carbon monoxide (CO) and carbon dioxide (CO₂) (col. 5, lines 34-41). Somekh discloses providing an oxidizer in an activated state using methods such as thermal activation, microwave activation, plasma discharge, and ozone activation (col. 6, lines 38- 45) to chemically transform the carbon deposits into CO and CO₂ and subsequently removing the different gaseous entities (col. 5, lines 33-40).

In determining the differences between the prior art and the claims, the question under 35 U.S.C. § 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. MPEP 2141.02 (I). As a whole, the presently claimed invention is directed to a process of outgassing AMC by contacting at least a portion of the substrate with a purified purge gas. According to the Oxford English Dictionary, the term “outgas” means “to drive off sorbed gas or vapour from a solid” (definition attached hereto). The carbon contamination on the mask as described by Somekh are solid “deposits,” and not AMC absorbed at the mask surface. Therefore, Somekh does not disclose outgassing the AMC from a surface of the organic contaminated substrate, as presently claimed.

Further, Applicants maintain that Wu fails to disclose the presently recited temperature ranges. In response to the Applicants' previous argument that the term "ambient," as described in the disclosure of Wu at column 3, lines 1-4, does not amount to a teaching or suggestion of "contacting at least a portion of the substrate with a purified purge gas at a temperature of about 20-100°C," the Examiner reiterated the language provided in Wu, which states:

The temperature set point is usually chosen to be the same as the ambient temperature in the vicinity of the mask 240 in the stepper. The temperature of the purge gas 215 is controlled to +/-0.2 degree Centigrade. (Emphasis added)

The Compact Oxford English Dictionary (Second Edition) provides the following non-rare (note that entries 1, 2, 5 and 6 are denoted as being rare) definitions of ambient (entries are attached hereto):

3. Lying round, surrounding, encircling, encompassing, environing.
4. Surrounding as a fluid; circumfused.

Thus, as stated previously in the context of Wu, the term "ambient" refers to the temperature of the fluid surrounding the mask in the stepper, not any particular numerical temperature value.

In further support of Applicants' position, Wu specifically states "...ambient temperature in the vicinity of the mask." If the above statement were intended to mean that the temperature set point is chosen to be ambient/room temperature, as suggested by the Examiner, Wu would simply have stated "The temperature set point is usually chosen to be ambient temperature."

The Examiner further stated that it is well known in the cleaning art, as evidenced by U.S. Patent No. 4,276,368 of Heller *et al.* ("Heller") that ambient temperature refers to room temperature.

Applicants respectfully disagree that Heller evidences that ambient temperature necessarily means room temperature. At col. 8, lines 7-9, Heller states:

Examples were generally conducted with development carried out at ambient temperature (room temperature).

If it were indeed well understood in the cleaning art that ambient temperature refers to room temperature, as suggested by the Examiner, it would not have been necessary for Heller to

parenthetically clarify that the term ambient, for the purposes of that particular disclosure, means “room temperature.”

Applicant’s own priority application, Provisional Application No. 60/475,145, also parenthetically clarifies what is meant by “ambient,” as that word is used in the Provisional Application (page 14 of Provisional Application No. 60/475,145)¹. Thus, the reference does not provide a specific temperature, much less the specific temperature range of about 20 to 100°C.

The Examiner indicated at paragraph 17 of the Office Action that the Examiner’s hindsight is proper because the application of the temperature range of about 20 to 100°C of Somekh was within the level of ordinary skill at the time the invention was made and does not include knowledge gleaned only from the applicant’s disclosure. As stated previously, Wu does not teach the presently claimed temperature range of about 20 to 100°C and Applicants are unable to find any such teaching within the Examiner’s cited prior art. Therefore, the Examiner’s hindsight is improper.

In response to Applicants’ argument that a person of ordinary skill in the art would not combine Somekh and Wu because high temperatures are required to carry out the method of Somekh, as evidence by Exhibits A and B, the Examiner indicated at paragraph 18 of the Office Action that the Exhibits A and B are not persuasive because they are directed to different methodologies that are “unrelated to the photolithographic process and a purge gas.” However, it is irrelevant that Exhibits A and B are unrelated to a photolithographic process and purge gas. Applicants submitted these exhibits to establish the temperature range required to oxidize carbon. The reaction temperatures demonstrated in Exhibits A and B are parameters of general chemical reactions in which carbon undergoes oxidation; the behavior of chemical reaction itself is independent of the particular application in which the chemical reaction is being used.

Additionally, Applicants note that U.S. 5,786,042 of Inoue *et al.* (Inoue), which the Examiner has cited as evidence that carbon is oxidized at room temperature (asserted by the Examiner at page 13, paragraph 18 of the Office Action), also is not related to a photolithographic process. Applicants further note that Inoue does not actually state that carbon

¹ The first full paragraph on page 14 of Provisional Application No. 60/475,145 states:

Purification and cleaning of components and apparatuses is preferably carried out at temperature between ambient temperatures (about 20°C) to about 50°C. (Emphasis added).

powder is oxidized by dioxygen (O₂) at room temperature, but merely states that carbon black can be kept at a pH of 6.5 or less by bringing carbon powder into contact with free (i.e., not chemically bound in a molecule) oxygen at room temperature (col.2, lines 55-59).

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Claims 14-15, 40 and 50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Somekh in view of Wu and Alvarez as applied above, and further in view of U.S. Patent No. 6,724,460 of Van Schaik (“Van Schaik”).

The Examiner asserts that Van Schaik teaches purging with nitrogen and that it would have been obvious to a person of ordinary skill in the art to have modified the method of Somekh to include purging with an inert gas. With regard to claim 40, the Examiner states the Van Schaik teaches 20% of oxygen.

Claims 14, 15, and 50 are directed to purging the substrate with an inert gas to remove at least one of oxygen and water after removing the contaminated purge gas from the substrate, not merely purging with nitrogen. As stated in the present application at page 13, lines 24-30:

...an oxygen and water containing purge gas...is removed by purging with a dry gas including...nitrogen or other inert gas to remove the water, which is incompatible with a number of high purity applications...an oxygen containing purge gas is removed by purging with nitrogen or another inert gas, if the device is to be placed into service where oxygen is considered undesirable.

That is, an inert purge gas is used to purge a system of the presently claimed purge gas comprising oxygen and water in order to remove said latter purge gas after outgassing AMC from contaminated surfaces, when its presence in the system may be no longer considered desirable.

Van Schaik fails to teach or suggest purging the substrate with an inert gas after removing the contaminated purge gas from the substrate. Thus, in addition to the reasons stated above with respect to Somekh and Wu, claims 14, 15, and 50 are patentable over the Examiner's cited references.

With regard to claim 40, the Examiner stated that Van Schaik teaches 20% of oxygen at col. 9, lines 40-45. Actually, col. 9, lines 40-45 of Van Schaik teaches “20% of an oxygen-

containing species” (Emphasis added), which the reference defines as water, nitrogen oxide, and oxygen-containing hydrocarbons” (col. 4, lines 6-8). In any case, the reference fails to specify whether the 20% is weight basis, molar basis, or volumetric basis. Therefore, this reference fails to teach “wherein the purified purge gas comprises oxygen at a concentration between about 1% and 25% on a volume basis,” as recited in claim 40 of the present application.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Claims 1, 3-5, 8-9, 11, 38, 40-41, 43-47 and 51-54 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2005/0017198 of Van Der Net (“Van Der Net”) in view of Alvarez.

Applicants respectfully disagree with the Examiner’s position at page 14, paragraph 20 of the Office Action, that the claimed invention is not supported by the provisional application, and therefore the effective filing date of the instantly claimed invention is 10/10/03, after the filing date of Van Der Net.

The present claims are supported by the specification. For example, regarding claim 1:

Claim Element	Support from Provisional Application No. 60/475,145
outgassing the AMC from a surface of the organic contaminated substrate	Pages 6 and 7 – 2.2. Procedure describes outgassing of contaminated valves
by contacting at least a portion of the substrate with a purified purge gas	Page 6 – “Purified sample case (N2 and CDA) was sent through each VUT...” Page 7 – “The purge gas was then changed to XCDA. The sample purge procedure was then repeated for each of the previously nitrogen purged VUT.”
at a temperature of about 20 °C to 100 °C	Page 14 – “Purification and cleaning of components and apparatuses is preferably carried out temperature between ambient temperatures (about 20°C) to about 50°C. Cleaning may be carried out at high temperatures, up to 100°C or even 150°C.”
the purified purge gas comprising oxygen (O ₂) and water,	Page 15 - “[i]t is possible to add a bubbler or other wetting device for dry XCDA gas...therefore you dry the XCDA and then

	remoisturize it with ultrapure H2O...”
the purified purge gas having an AMC concentration less than about 1 part per trillion (ppt) on a volume basis,	<p>Page 1 – The effects of AMCs have been previously studied...some common contaminants and their effects...are shown in Table 1.</p> <p>Table 1</p> <p>Page 2 – “XCDA is the result of polishing readily available clean dry air to contain less than 1 ppt per species for non-methane hydrocarbons, sulfur compounds, and siloxanes...”</p>
, the substrate contaminated with AMC before the substrate is contacted with the purified purge gas;	Page 10 – “The generally accepted protocol for UHP gas line validation requires extensive purging with nitrogen...[h]owever, with all three VUT’s XCDA volatized additional hydrocarbons...”
producing a contaminated purge gas by transferring a portion of the outgassed contaminants from the substrate into the purified purge gas removing the contaminated purge gas from the substrate, thereby removing AMC from the substrate.	Page 6 – “As the gas is purged through the VUT, any desorbed contaminants are collected downstream....”

Thus, Van Der Net does not constitute prior art with respect to at least claim 1 of this application. The prior art date of Van Der Net is its filing date of July 21, 2003. The present application claims the benefit of U.S. Provisional Application No. 60/475,145 filed on June 2, 2003. Since Van Der Net does not constitute prior art, the rejection is improper.

It is noted that claim 51 was only rejected as unpatentable over Van Der Net in view of Alvarez. Claim 51 is similar to claim 1, but recites that the purge gas is a humidified purge gas comprising XCDA. Since humidified XCDA is taught in U.S. Provisional Application No. 60/475,145 at pages 14 and 15, Van Der Net does not constitute prior art with respect to claim 51. Thus, claim 51 is patentable.

Nevertheless, assuming *arguendo* that Van Der Net is a valid prior art reference to the present application, a person of ordinary skill in the art would not have been motivated to combine the teachings of Van Der Net and Alvarez. Van Der Net teaches adding moisture to a purge gas to make it effective in reducing contamination, while Alvarez states that it is important to effectively remove water.

In response to the Applicants' arguments supporting lack of motivation to combine the references, the Examiner stated that Van Der Net teaches that the purge gas can have an amount of moisture within the range of 0-100% and that as one possible embodiment, the purge gas of Van Der Net could have water in the ppm range.

Applicants maintain the arguments as set forth in the Reply dated April 30, 2009 and the Reply dated November 30, 2009. The Examiner's argument that "as one possible embodiment" the purge gas could have water in the ppm range ignores the requirement of a reasonable expectation of success, as set forth in MPEP 2143.02. Given the fact that Van Der Net teaches that more than 25% relative humidity provides good results and about 40% provides optimal results, a person of ordinary skill in the art would not have had a reasonable expectation of success in employing a water concentration in the ppm range, as suggested by the Examiner.

Further, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. MPEP 2143.01 (V) (Emphasis added). In this case, to carry out the invention of Van Der Net effectively, the reference requires the presence of water in an amount greater than that disclosed by Alvarez (i.e., the order of 1 ppb or lower; col. 7, lines 8-9 of Alvarez). Thus, the Examiner's proposed modification of Van Der Net in view of Alvarez renders the invention of Van Der Net unsatisfactory of its intended purpose.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Claims 14-15 and 50 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Van Der Net in view of Alvarez as applied to claims 1, 3-5, 8-9, 11, 38, 40-47, and 49 and further in view of Van Schaik.

The Examiner's rejection is improper for the same reasons with respect to claims 1, 3-5, 8-9, 11, 38, 40-41, 43-47 and 51-54 set forth above. In addition, Applicants assert the same

arguments set forth above with regard to the Examiner's rejection of claims 14-15, 40 and 50 under 35 U.S.C. § 103(a) as over Somekh in view of Wu, Alvarez and Van Schaik. That is, Van Schaik fails to teach or suggest purging the substrate with an inert gas after removing the contaminated purge gas from the substrate.

Reconsideration and withdrawal of this rejection are respectfully requested.

Claims 52 and 53 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Van Schaik in view of Alvarez.

With regard to claim 52, the Examiner stated, "Van Schaik teaches that...the contaminants are removed and not chemically altered." Applicants respectfully direct the Examiner's attention to Van Schaik at col. 7, lines 51-54, which states, "As these OH-radicals are located near to or on the hydrocarbon contaminant residing on said surface, it reacts readily therewith." Thus, the purge gas comprising molecular oxygen and water, as described in Van Schaik, reacts with the contaminants, contrary to the Examiner's assertion.

With regard to claim 53, the Examiner's rejection, which relies upon the indefiniteness rejection discussed above, is improper in view of the Applicants' above arguments in response to the Examiner's rejection under §112, second paragraph.

Further, a claim limitation which is considered indefinite cannot be disregarded. MPEP 2143.03 (I). If a claim is subject to more than one interpretation, at least one of which would render the claim unpatentable over the prior art, the examiner should reject the claim as indefinite under 35 U.S.C. § 112, second paragraph and should reject the claim over the prior art based on the interpretation of the claim that renders the prior art applicable. Id., (Emphasis in original). Here, the Examiner has failed to provide support for the rejection under § 103(a) and the rejection is therefore improper.

Reconsideration and withdrawal of the rejection are therefore respectfully requested.

Double Patenting Rejections

The Examiner rejected claims 1, 3-5, 11, 14-15, 38, 40-41, 43-45, 50 and 52-54 on the ground of nonstatutory obviousness-type double patenting over claims 1-4, 7, 9-14, and 20-23 of

U.S. Patent No. 7,189,291. Applicants will address this issue upon indication of allowable subject matter.

The Examiner rejected claims 1, 3, 8, 11, 14-15, 38, 41, 43, 46 and 50-54 on the ground of nonstatutory obviousness-type double patenting over claims 1, 6, 11-21 and 23-24 of U.S. Patent No. 7,377,982. Applicants will address this issue upon indication of allowable subject matter.

Supplemental Information Disclosure Statement

An Supplemental Information Disclosure Statement (SIDS) is being filed concurrently herewith. Entry of the SIDS is respectfully requested.

Request for Interview


Applicants respectfully request an interview with the Examiner before the issuance of another Office Action or other communication.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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Date: MARCH 30, 2010

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Air Composition

Dry air is a mechanical mixture of nitrogen, oxygen, carbon dioxide and more

Air is a mixture of gases - 78% nitrogen and 21% oxygen - with traces of water, vapor, carbon dioxide, argon, and various other components. Air is usually modeled as a uniform (no variation or fluctuation) gas with properties averaged from the individual components.

Gas	Ratio compared to Dry Air (%)	By volume	By weight	Molecular Mass - M - (kg/kmol)	Chemical Symbol	Boiling Point (K)	Freezing Point (°C)
Oxygen	20.95	78.09	23.20	32.00	O ₂	90.2	-182.95
Nitrogen	78.09	0.03	75.47	28.02	N ₂	77.4	-195.79
Carbon Dioxide	0.03	0.0006	0.045	44.01	CO ₂	194.7	-78.5
Hydrogen	0.00006	~ 0	~ 0	2.02	H ₂	20.3	-252.87
Argon	0.933	1.28	0.933	39.94	Ar	84.2	-186
Neon	0.0018	0.0012	0.0012	20.18	Ne	27.2	-246
Helium	0.0005	0.0007	0.0007	4.00	He	4.2	-269
Krypton	0.0001	0.0003	0.0003	83.8	Kr	119.8	-153.4
Xenon	9.10 ⁻⁵	0.0004	0.0004	131.29	Xe	165.1	-108.1

- The water or vapor content in air varies. The maximum moisture carrying capacity of air depends primarily on temperature
- The composition of air is unchanged until elevation of approximately 10,000 m
- The average air temperature diminishes at the rate of 0.6°C for each 100 m vertical height
- One Standard Atmosphere is defined as the pressure equivalent to that exerted by a 760 mm column of mercury at 0°C sea level and at standard gravity (32.174 ft/sec²)

Other components in air

- Sulfur dioxide - SO₂ - 1.0 parts/million (ppm)
- Methane - CH₄ - 2.0 parts/million (ppm)
- Nitrous oxide - N₂O - 0.5 parts/million (ppm)
- Ozone - O₃ - 0 to 0.07 parts/million (ppm)
- Nitrogen dioxide - NO₂ - 0.02 parts/million (ppm)
- Iodine - I₂ - 0.01 parts/million (ppm)
- Carbon monoxide - CO - 0 to trace (ppm)
- Ammonia - NH₃ - 0 to trace (ppm)

Common Pressure Units frequently used as alternative to "one Atmosphere"

- 76 Centimeters (760 mm) of Mercury
- 29.921 inches of Mercury
- 10.332 Meters of Water
- 406.78 inches of Water
- 33.899 Feet of Water
- 14.596 Pounds-Force per Square Inch
- 2116.2 Pounds-Force per Square Foot
- 1.033 Kilograms-Force per Square Centimeter
- 101.33 Kilopascals

More about Temperature, Density, Specific Heat, Thermal Conductivity, the properties of air.

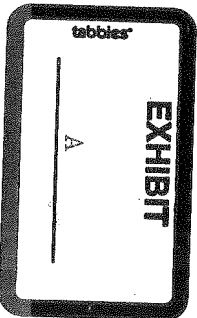
ANSI Z39.18 THE QUALITY STANDARD FOR THE ENGINEERING TOOLBOX

Related Topics

- Air Psychrometrics: The study of moist and humid air - air condition - psychrometric charts, Moller diagrams, air temperature, absolute and relative humidity, moisture content and more ..
- Material Properties: Material properties - density, heat capacity, viscosity, and more - for gases, fluids and solids

Related Documents

- Air Properties: Temperature, density, specific heat, thermal conductivity, expansion coefficient, kinematic viscosity and Prandtl numbers a number for temperatures ranging 150 - 400 °C
- Specific Heat: Ratio of Air Specific Heat Ratio of air at temperatures from -40 - 1200 °C (-40 - 500 °F) at standard atmospheric pressure - Imperial and SI Units



Convert |

Pressure

Pa (N/m²)

bar

mm H₂O

kg/cm²

psi

mmHg

Convert |

Unit Converter

Convert |

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US gallon

US gallon

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- Humid Air and the Ideal Gas Law: The ideal gas law relating pressure, temperature, and volume of an ideal or perfect gas used for air with water vapor - or moist air
- Molecular Mass of Air: Dry air is a mixture of gases where the molecular weight can be calculated by adding the weight of each component
- Density of Dry Air, Water Vapor and Moist Humid Air: Calculate the density of dry air, water vapor or the mixture of air and water vapor - moist or humid air
- Dry Air Properties: Dry air properties at temperatures ranging 175 - 1000 K - specific heat capacity, ratio of specific heats, dynamic viscosity, thermal conductivity, Prandtl number, density and kinematic viscosity
- Nitrogen: Specific heat capacity, specific heat capacity of Nitrogen Gas - N₂ - at temperatures ranging 175 - 6000 K
- Oxygen: Specific heat capacity, specific heat capacity of Oxygen Gas - O₂ - at temperatures ranging 175 - 6000 K
- Ideal Gas Properties: Oxygen Enthalpy, Internal Energy and Entropy of Oxygen

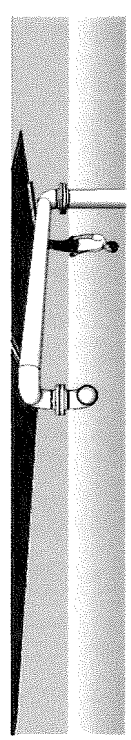
Drivers who switched from GEICO to Allstate saved an average of \$473 a year.



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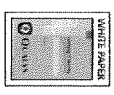
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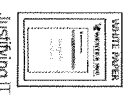
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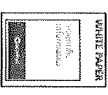



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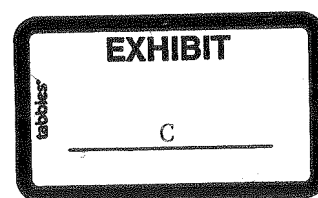
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DICTIONARY

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COMPLETE TEXT
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1991



bering (æmberɪŋ), *vbl. sb.* [f. AMBER v.] 53 CHAMBERS *Cycl. Suppl.*, *Amberring* is used by some 275 to denote the giving a scent or perfume of amber to hng.

berjack. Also amber jack. [AMBER sb.¹] A cles of amber-fish, esp. *Seriola dumerilii*. 93 *Funk's Stand. Dict.*, *Amber-jack*, an amber-fish *iota laianis*: 1897 [see prec.], 1960 *Catal. Names Fishes* 11 (Gen. Fish. Council Medit.) 161 *Seriola dumerilii* per jack.

beroid, var. AMBROID.

ber-seed. [f. AMBER sb.¹ in reference to its agreeable odour and use.] An old name for seeds of *Abelmoschus moschatus*, also called isk-seed, and Ambrette, used to perfume f-powder, pomatum, etc. 27-51 CHAMBERS *Cycl.*, *Ambur-seed* or *Musk-seed*. s a grateful scent to the breath.

ber-tree. [f. AMBER sb.¹ in reference to the grant odour of its leaves.] A common name of genus *Anthospermum*, consisting of rgreen shrubs with leaves fragrant when ised. 147 CRAIG, *Anthospermum*, the Amber-tree, a heath- ing shrub from the Cape of Good Hope.

bery (æmberɪ), *a.* [f. AMBER sb.¹ + -Y.] Of nature or colour of amber. 162 THORBURY *Turner* I. 80 A landscape-painter, ured for a rich amberly tone he knew how to give.

bery, obs. form of AMBRY.

ibes ace. ambes-as, obs. ff. AMBS-ACE.

ibi- (æmbi), repr. L. *ambi-* both, on both es (*ambo* both), in various (chiefly scientific) ns (see words in *ambi-*). *ambiciliate* (-siliat), *Ichth.*, having the scales on both sides of the ly minutely toothed along the edges; *bicolorate* (-'kolarat, -'kal-) *a.* *Ichth.*, applied lat-fishes abnormally coloured on both sides ead of having the under side white; so *bicoloration*. 194 *Proc. Zool. Soc.* 439 *Ambicolorate* fish appear to be ivs what one may call *ambiciliate*; also *Ibid.* 435 Why lopean examples should be *ambicolorate*. *Ibid.* (reading) On an Adult Specimen of the Common Sole, with mtrical Eyes, with a Discussion of its bearing on bicoloration.

mbiate, *v.* *Obs. rare*⁻¹. [irreg. f. L. *ambi-re* (AMBITION) + -ATE³.] To desire earnestly, be bitious of, ambition.

52 SPARK *Prim. Devotion* (1663) 162 You few that dom above treasure prize, And *ambiate* the title of the

mbidexter (æmbi'dekstə(r)), *a.* and *sb.* Also *ambodexter*. [a. med.L. *ambidexter* (used in ses 2, 3), f. *ambi(i)-* both, on both sides + *-ter* right-handed. In 17th c. generally spelt *bodexter*, after L. *ambo* both.] *A. adj.* *lit.* Right-handed on both sides, able to use left hand as well as the right. 646 SIR T. BROWNE *Pseud. Ep.* 10: So may Aristotle say, I only man is *Ambidexter*. 1751 SMOLLETT *Per. Pic.* 701 IV. XCIX. 202 Being *ambi-dexter*, he raised, a clatter in the turner's blind side. 1880 BLACKMORE *M. Anierley* xvi. 283 With his left hand, for he was *ambidexter*, he ght up a handspike.

Double-dealing; practising on both sides. 613 SIR H. FINCH *Lett.* (1636) 186 To call, an Artornie *bodexter*, or to say that he dealeth corruptly. 1624 F. S. SHAKS *Cent. Praise* 154 These *ambi-dexter* Gibionites. 5 HICKERINGILL *Prestit-er* I. (1721) 44 Nor *Ambodexter* syers take a Fee On both sides. 1856 DOVE *Logic Chr.* 116 I. II. 52-4 Tortuous and *ambidexter* sophistries.

Of or belonging to both hands or sides; o-sided. 806 W. TAYLOR *Ann. Rev.* IV. 228 Posted by double ry with the *ambidexter* formality of an Italian ledger. 9 SIR J. STEPHEN *Ess. Eccl. Biog.* (1850) II. 37 An *bodexter* controversialist, the English Church warred at e with the errors of Rome and of Geneva. 3. *sb.* [The adj. used *absol.*] *One who uses the left hand as well as the ht; hence fig. a man of unusual dexterity.* 598 FLORIO *Dec.* 1. If we be not *ambidexters*, using both igs alike. 1615 CROOKE *Body of Man* 732 A woman, saith ocrates, cannot be an *Ambidexter*. 1753 CHAMBERS *Cycl.* 29. s.v., Surgeons and oculists are of necessity obliged to *Ambidexters*.

l. Late. One who takes bribes from both sides, he earliest sense in Eng.)

532 *Use of Dice Play* (1850) 17 Any affinity with our men and never with those that be honest, Marry, with such e *ambidexters*, and use to play in both the hands. 1652 SLOWE *Theoph.* XIII. xviii. 28 From costly bills of greedy upricky free, From plea of *Ambodexters* fee. 1691

825 In this Battell I esp'd Some *Ambodexters*, fight on either side. 1703 DE FOS *Ref. Manners* 93 Those *Ambodexters* in Religion, who Can any thing dispute, yet any thing can do. 1864 SIR F. PALGRAVE *Norm. & Eng.* [II. 278 An *Ambidexter*, owing fealty to both Counts and not faithful to either

ambidexterity (æmbi'dekstəri), [f. prec. + -ITY, after *dexterity*.]

1. The power of using both hands alike. a 1652 BROME *Court Beggar* I. 191 Some Tellers Clearke to teach you *Ambodexterity* in telling money. 1753 CHAMBERS *Cycl. Suppl.* s.v., Plato enjoins *Ambidexterity* to be observed and encouraged in his republic. 1881 *Times* 2 Feb. 10 s The single-stick play, was remarkable for its *ambidexterity*.

2. *fig.* Superior dexterity or cleverness; shiftiness or general readiness; many-sidedness. 1760 STERNE *Trist. Shandy* III. XXXVIII. 103 Speculative subtilty or *ambidexterity* of argumentation. 1804 W. TAYLOR *Ann. Rev.* II. 278 The idiomatic *ambidexterity* of a patriot of both countries. 1858 DE QUINCEY *Autobiog. SR.* Wks. II. II. 76 Presence of mind, and a general *ambidexterity* of powers for facing all accidents.

3. Double-dealing. 1755 IN JOHNSON. 1841 D'ISRAELI *Amer. Lit.* (1850) I. 362 That intricate net of general misery, spun out of his own crafty *ambidexterity*.

ambidextral (æmbi'dekstrəl), *a.* *rare*. [f. L. *ambidexter* + -AL.] Belonging to both sides.

1871 EARLE *Philol. Eng. Tong.* 884 What may be called the *ambidextral* adjective. Thus Chaucer—'I say the woful day fatal is come.'

ambidextrous, -erous (æmbi'dekstrəs), *a.* [f. med.L. *ambidexter* + -OUS] = AMBIDENTER.

1. Able to use both hands alike. 1646 SIR T. BROWNE *Pseud. Ep.* 188 Not considering *ambidextrous* and left handed men. 1751 CHAMBERS *Cycl.* s.v., Women, according to the observation of Hippocrates, are never *ambidextrous*. 1878 BRYAN *Pract. Surg.* I. 340 Every ophthalmic surgeon should become *ambidextrous*.

2. *fig.* More than usually dextrous, or clever. 1682 SIR T. BROWNE *Chr. Mor.* (1756) 117 Many, who are sinistrous unto good actions, are *ambidextrous* unto bad. 1844 *Blackw. Mag.* LVI. 54 O many-sided, *ambidextrous* Goethe.

3. Acting in two opposite directions; and in a bad sense. Double-dealing; humouring both parties.

1654 GATAKER *Disc. Apol.* 77 An *ambidextrous* Trick, of divers persons in the same family adhering some to one party and some to another. a 1768 STERNE *Pol. Romance* (1774) 316 A little dirty, pimping, pettifoggng, *ambidextrous* fellow. a 1847 CHALMERS *Faith. Wks.* I. 22 Rebuking Peter for his *ambidextrous* policy between Jews and Gentiles. 1858 J. MARTINEAU *Stud. Chr.* 279 It would be hypercritical to complain of the antithesis of understanding and feeling, sense and soul. But to an exact thinker, an *ambidextrous* intellect is no intellect at all.

ambidextrously, -erously *adv.* [f. AMBIDENTROUS, -EROUS *a.* + -LY².] In an *ambidextrous* manner; with both hands; with more than usual dexterity; cunningly. 1791-1823 D'ISRAELI *Chr. Lit.* 459 To prove himself not to have been the author, [he] *ambidextrously* published another. 1837 *Blackw. Mag.* XLI. 439 *Ambidextrously* plying her knitting-needles

ambidextrousness. [f. as AMBIDENTROUSLY *adv.* + -NESS.] The quality of being *ambidextrous*; *ambidexterity*. 1721 IN BAILEY. 1881 *Sat. Rev.* No. 1323. 301 The remarkable *ambidextrousness* which he shows.

+ *ambidextry*, *Obs. rare*⁻¹. In 7 *ambo-* [ad. med.L. *ambidextria*, f. *ambidexter*.] Double-dealing. Cf. AMBIDENTER B 2. 1611 *Brief in 3rd Rep. R. Comm. Hist. MSS.* (1872) 587 For *ambodextry* and disturbing the King's service, and threatening the jurors

ambience (æmbiəns). Also *ambiance* (æmbiəns). [f. AMBIENT *a.*; see -ENCE; cf. F. *ambiance*.] Environment, surroundings; atmosphere. The Fr. form *ambiance* is used in *Art* for the arrangement of accessories to support the main effect of a piece. 1880 *Harper's Mag.* Sept. 500:2 The form which we discern in the dreamy ambience is of supreme elegance. 1902 W. WATSON *Ode on Coronation of King Edward VII* 5 Slowly in the ambience of this crown Have many crowns been gathered. 1923 R. H. MYERS *Mod. Music* IV. 47 No other composer has ever reproduced in music with such complete success the very perfume and ambience of a literary text. 1944 *Burlington Mag.* June 156: 1 But the present picture was never meant to be microscopically dissected thus, for it is, an impression, a single figure in its *ambience*, which is vaguely suggested as reflections in a mirror. 1952 *Bullet. Ann. N.Y.* 25 The costumes and sets, have such a suggestion of space that they give the Sadler's Wells stage the *ambience* of Covent Garden. 1957 *London Mag.* Jan. 32 For some writers the urban ambience may provide just the kind of stimulus they need. 1961 *Listener* 5 Oct. 527:2 The Zoo provides a colourful ambience for this Administrative Nuptials. Annie Wilson's Old Man at the

so called from the way in which it winds in passing from the hip to the foot.

1873 A. H. GARROD in *Proc. Zool. Soc.* 630 The ambiens and the accessory femoro-caudal arc absent. 1884 COUES *N. Amer. Birds* (ed. 2) 193 The ambiens arises from the pelvis about the acetabulum, and passes along the inner side of the thigh

ambient (æmbiant), *a.* and *sb.* [ad. L. *ambientem* pr. pp. of *ambire* to go about, to f. *amb-* on both sides, round, about + *-ire* to go. Cf. It. *ambiente* bef. 1600.] *A. adj.*

1. Turning round, revolving. *Obs. rare.* 1614 CHAPMAN *Odyss.* I. 28 The point of time wrought out by *ambient* years. 1620 — *Homer's Hymns* Ep. Ded. Of all arts *ambient* in the orb of Man. 2. Moving round, circling about (something). *rare.*

1655-60 STANLEY *Hist. Philos.* (1701) 64: 1 The *ambient* ether, by the swiftness of its Motion, snatcheth up Stones from the Earth. 1692 BENTLEY *Boyle Lect.* 234 That the planets should naturally attain these circular revolutions, by impulse of *ambient* bodies. 1834 DISRAELI *Rev. Epick* I. XXX. 15 Ye *ambient* Winds, That course about the quarters of the globe.

3. Lying round, surrounding, encircling, encompassing, environing.

1596 BELL *Sury. Popery* I. xvi. 69 As well for the *ambient* restraint. 1658 SIR T. BROWNE *Gard. Cyrus* I. 103 The tree of knowledge was placed in the middle of the Garden, what ever was the *ambient* figure. 1750 SHENSTONE *Elegy* IX. 38 Exalted to yon *ambient* sky. 1784 BOSWELL *Johnson* (1816) IV. 428 A captive in thy *ambient* arms. 1850 BLACKIE *Eschylus* II. 37 With echoing groans the *ambient* waste bewails Thy fate. 1928 E. A. WILCOX *Electric Heating* vi. 128 Tank temperatures are constantly maintained at 100° F. above surrounding (or *ambient*) temperatures. 1958 *Engineering* 28 Mar. 393:3 The air pressure within the dome is maintained at the not uncomfortable figure of 2 lb per sq in above the *ambient* pressure.

4. *esp.* Surrounding as a fluid; circumfused. 1605 BACON *Adv. Learn.* (1640) 201 Consumption is caused by, Depredation of innate Spirit, and Depredation of *ambient* Aire. 1667 MILTON *P. L.* VI. 481 Opening to the *ambient* light. 1711 POPE *Temp. Fame* 26 Whose tow'ring summit *ambient* clouds conceal'd. 1806 VINCE *Hydrast.* x. 110 If the plate be cold, and the *ambient* fluid be warm. 1866 KINGSLY *Herein* v. 104 It diffused a delicate odour through the *ambient* air. 5. Rounded like a solid body. *rare.*

1801 FUSSELL *Lect. Art.* I. (1848) 360 He who decided his outline with such intelligence that it appeared *ambient*, and pronounced the parts that escaped the eye.

+6. Ambitious, aspiring. (A Latinism.) *Obs. rare.*

1647 N. BACON *Hist. Disc.* III. 12 The Clergy, soon began to be *ambient*; and concept a new Idea of department

+7. As an epithet of the air, often ignorantly put for 'limpid,' or otherwise misused.

B. sb. [The adj. used *absol.*]

+1. A canvasser, suitor, or aspirant. *Obs. rare.*

1640 BR. HALL *Confirmation* (1651) 16 What Fair-like confuences have we there seen of zealous *ambients*?

2. An encompassing circle or sphere.

1624 WOTTON *Elem. Archit.* (1672) 7 The arc, being a perpetual *ambient* and ingredient. 1659 TOMLINSON *Remou's Disp.* 547 They are broad, asperated about their *ambient*. 1864 MACVICAR in *Reader* IV. 679: 1 Atoms or molecules have extensive atmospheres or *ambients* of some kind.

3. *Astrol.* The *ambient* air or sky.

1686 GOAD *Celeft. Bodies* III. III. 472 B and J, by the Repetition of the Aspect, may sometimes disturb the *Ambient* above a year. 1868 GEO. ELIOT *Sp. Gypsy* 193 For the *ambient*. Though a cause regnant, is not absolute.

ambiente (æmbi'entei), [It. and Sp., f. L. *ambient-em*; see AMBIENT *a.* and *sb.*] = AMBIENCE.

1926 D. H. LAWRENCE *Plumed Serp.* XII. 197 He was utterly still, soft and unroused, within his own *ambiente*. 1927 — *Lett.* (1962) II. 988 So with the mind. One's *ambiente* matters awfully. 1965 *House & Garden* Dec. 37: 1 Within the entertaining *ambiente* of this decoratively practical kitchen-dining-room. 1966 M. STEEN *Looking Glass* IV. 75, I couldn't afford it, but I liked the *ambiente*

+ *ambifarious*, *a.* *Obs.*⁻⁹ [f. L. *ambifari-us* two-sided, of double meaning + -OUS.] 'Double, or that may be taken both ways.' Blount *Glossogr.* 1656; whence in Bailey 1721.

+ *ambiform*, *a.* *Obs.*⁻⁹ [ad. L. **ambiform-is* (in adv. *ambiformiter*), f. *ambi(i)-* both + -*formis* -shaped.] 'Having a double form.' Bailey 1721.

+ *ambigate*, *v.* *Obs. rare*⁻¹. [irreg. f. L. *ambigere* to go round (taken as = *ambire*; see AMBITION) + -ATE³.] = AMBIATE.

1633 T. ADAMS *Exp. 2 Pet.* 1. 6 There are some things, wherein it is no godliness to *ambigate* a likeness to God.

ambigenal (æm'bidʒɪnəl), *a.* [f. (by Newton) L. *ambigena* (gen. *ambigenae*) = *ambigere* + *genus* (gen. *genus*)

ambigen *spec.* of calyx, petaloid 1850 H. Les.

+ *ambi* prop. at which together on.

1688 *Littler's Nat. Life* (1841) L166: 17 of mixed served to

+ *ambi* 'ambigu' 1683 C some amb the news

+ *ambi* 'Fr. ar' a 1733 of rumm

ambig etc. [f. med.L. AMBIGU + I.]

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1400+

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outfront leadership. 1976 L. ALTHEA Kimpflich ii. 22 'Have you seen the new fishburger franchise?' Mrs Yancy asked, pointing out the window at a red and silver building with a sign out front featuring in neon a one-legged pirate tangoing with a laughing swordfish. 1977 New Yorker 10 Oct. 156/3 Powell himself was said to be deeply bothered by that, and to have realized that he had been too 'out front' on the issue.

outfrown, v. [OUT- 23 u, 18 c.] trans. To outdo in frowning; to frown down, overbear by frowning.

1605 SHAKS. Lear v. iii. 6 My selfe could else out-frowne false Fortunes frowne. 1807 W. H. IRELAND Mod. Ship Poets 61 note. It is only the base-born churl, like Thomas à Becket, that would out-frown the brow of majesty.

†out-funeral. Obs. rare⁻¹. [OUT- 1.] A funeral outside a city; extra-mural interment.

1637 BP. HALL Sermon at Exeter 24 Aug. (R.). Much might be said to this purpose [out of matter of wholesomnesse] for the convenience of out-funerals.

out-ga, outgait, obs. ff. OUTGO, OUTGATE.

out-gallop, v. [OUT- 18.] trans. To outdo in galloping; to gallop faster than.

1603 DEKKER Wonderful Yearre Dijkh. They that rode on the lushest geldings, could not out gallop the Plague. 1852 THACKERAY Esmond III. I. A hundred huntsmen... each out-hawking and out-galloping the other.

'outgang. Now Sc. or north. dial. [OUT- 7; OE. útgang; cf. Du. uitgang, Ger. ausgang.]

1. A going out, departure, exit; the giving up of the occupancy or tenure of property.

1825 J. esp. Psalter xviii. [ix.] 7 From dem been heofene utgang his. a 1000 Life St. Guthlac ii. (1848) 14 burh sarlicne utgang þæs manfulan lifes. a 1300 E.E. Psalter xxx. 23 [xxx. 22] In out-gang of thoghte mine. c. 1320 Cust. Love 878 þorn þe faste 3at he con in teo. And at þe out-3ong he leitte faste beo. 1887 Jamieson's Sc. Diet. Suppl. Out-gangung. . . Outgang. . . outgoing, removal; the act of giving up possession of burghal property.

2. The way or passage out; an outlet, an exit; a road by which cattle went out to the pasture.

1950 Lindisf. Gosp. Matt. xxii. 9 Geomgas forþon to ut-geonge ðære wegara [c. 975 Ræshic. to utgeungum wegosa]. a 1300 E.E. Psalter cxlii. [cxlv.] 16 þair schepe brodefulle mightsomande In þar out-gange. c. 1450 Customs of Mallum in Surtees Misc. (1888) 58 Fre entre and goving owie to yf more by a large way, the wybyche is called yf out-gang. 1513 DOUGLAS Aeneis (Cr. Gl.). Ane narrow path biþh outgang and entre. 1664-5 Act 10-17 Chap. II. c. 11 §2 The River of Welland from the Outgang at the East end of East Deeping. 1828 Craven Gloss. (ed. 2). Out-gang, a road from a place. 1896 T. BLASHILL Sutton-in-Holtshire 26 An ordinary out-gang was a place where the cattle of a village assembled when they were to be driven out together to graze in common.

out-garment, -garth, etc.: see OUT-.

outgas (aot'gas), v. [OUT- 26.] 1. trans. a. To drive off sorbed gas or vapour from (a solid), esp. by heating in a vacuum.

1921 [implied in OUTGASSED ppl. a.]. 1925 Physical Rev. XXVI. 658 When the surface layer of gas is removed from a fresh specimen the increase in the photo-electric current is greater than the decrease from the maximum value as the specimen is outgassed. 1953 Electronic Engin. XXV. 19 The cathodes were out-gassed by eddy-current heating. 1965 C. M. VAN ATER Vacuum Sci. & Engin. iii. 101 After the gauge tube and elements have been thoroughly outgassed, an opposite effect becomes noticeable.

b. To release (sorbed or dissolved gas or vapour).

1971 I. G. GASS et al. Understanding Earth ix. 137/2 Only gradually, as volcanoes continued to outgas volatile products still trapped in the mantle, will a secondary atmosphere and ocean have replaced the primary envelope. 1974 Nature 31 May 438/1 If NH₃ is outgassed from the Martian crust it will be photolysed.

2. intr. To give off sorbed gas or vapour.

1962 [implied in OUTGASSING vbl. sb.]. 1965 C. M. VAN ATER Vacuum Sci. & Engin. ix. 305 Untreated metal samples outgas at the rate of about 10⁻⁷ torr liter/sec cm² after 1 hr of vacuum pumping at room temperature. 1975 Sci. Amer. Feb. 110/3 Any polymer surface will outgas (a 'virtual leak' into your clean volume) two orders of magnitude more than steel.

So outgassed ppl. a., outgassing vbl. sb.

1921 Proc. Nat. Acad. Sci. VII. 115 The coarsely granular sample of the thoroughly outgassed material is weighed and placed in a steel pressure bomb which is then evacuated until all adsorbed gases are removed. 1925 Physical Rev. XXVI. 657 His thermionic measurements show that the value of A in the Richardson equation... decreases from 4.76 10⁻¹¹ for the slightly outgassed position to 1.7 x 10⁻¹² for continued outgassing. 1954 Trans. Faraday Soc. XLVIII. 730 The vessel F was protected by a series of traps in liquid air, some of which contained carefully outgassed granulated charcoal. 1962 F. I. ORDSWAY et al. Basic Astronautics ii. 49 Whatever outgassing that may occur from the surface would expectably give rise to a more substantial, albeit tenuous, atmosphere. 1971 I. G. GASS et al. Understanding Earth ii. 43/2 This so-called 'excess' argon is probably produced by heating and outgassing of ancient, potassium-bearing rocks. 1973 Nature 3 Aug. 272/2 The relative abundances of these gases will depend critically on the subsequent history of the outgassed methane. 1973 B. J. WILLIAMS Evolution of Human Origins vii. 97/2 If these dates are correct then the evolution of life must have begun, as we would expect, almost immediately after the earth's crust melted and the outgassing of the early atmospheric gases ceased.

'outgate, sb. (adv.) Also Sc. -gait. Now Sc. and north. dial. [OUT- 7.]

1. The action of going out; outgoing, passage out; exit, egress; debouching.

a 1300 E.E. Psalter cxiii. [cxiv.] 1 In out-gate of Israele Oute of Egypt. c. 1440 Pramp. Parv. 375/2 Owie gate, exitus. 1455 Rolls of Parlt. V. 311/2 Free ingate and outgate to the premisses. 1496, 1598 [see INGATE 1]. 1615 CROOKE Body of Man 766 The outgate of the breath is hindered. 1822 GALT Sir J. Hyde's l. xviii. 259 (Jam.) She... maybe a wee that dressy and fond of outgait. 1865 CARLYLE Fredk. Gl. xviii. ii. (1872) VII. 106 Moldau Valley... making, on its outgate at the northern end of Prag... one big loop.

2. A passage or way out, an outlet; a means of egress; fig. a way of escape or deliverance.

1456 SIR G. HAYE Law Armes (S.T.S.) 179 Thus suld never promess na obligation bynd a fals man, na he wald get ane outgate. 1513 DOUGLAS Aeneis ix. vii. 28 Some ombeset hae thai Th outgatis al for trade and trafficke, having most convenient outgates by diverse rivers to the sea. 1616 SURF. & MARKH. Country Farme 688 If he meet with a hedge, he holdeth along by the side of it, to see if he can find any out-gate. 1659 A. HAYE Diary (S.H.S.) 1900 194 The Lord provyd ane outgate for his people. 1865 CARLYLE Fredk. Gl. xx. ix. (1872) IX. 165 The dragoons were a hundred, and... every outgate was beset.

b. Issue, outcome. Sc.

1568 MARY Q. SCOTS in H. CAMPBELL Love-lett. App. (1824) 29 To the effect the armin suld be the main promptie endit with some happy outgait to my honour and contentment. 1663 BLAIR Autobiog. ii. (1848) 32 Wondering what would be the outgate. 1786 A. GR. SACR. Contempl. 318 Others are brought more quickly to an happy outgate.

†3. Usually in pl. Goods 'going' or carried out of a town or port, exports; also, export dues.

1621-1886 [see INGATE sb. 1].

B. adv. Outwards; outside, without.

1590, 1611 [see INGATE sb. 1 B]. 1898 CROCKETT Standard Bearer xxiv. 301 May they burn back and front, ingate and outgate.

'out-gate. Outer gate: see OUT- 3.

1648 Deput. Cant. York (Surtees) 12 Robert Kay, together with 16 or 18 men... with muskets and swords drawne... broke open the outgate and fewer other doores within the said house. 1664 J. WENN Stone-Heng (1725) 94 The Anditus had both an Out-gate, and an inner Gate.

out-gather, -gauge, etc.: see OUT-.

outgear (aotga(r)). Sc. rare. [OUT- 1.] Possessions or substance used in out-door occupation.

1834 H. MILLER Scenes & Leg. xxiv. [see INGBEAR].

out'general, v. [OUT- 22.] a. trans. To outdo or defeat in generalship; to get the better of as by superior military skill; to outmanoeuvre.

1767 S. PATENSON Another Trav. I. 202 How we were out-generalled indeed! 1776 J. ADAMS in Fam. Lett. (1876) 23 In general, our Generals were outgeneralled on Long Island. 1897 Century Mag. Feb. 495 In these movements Lee was entirely outgeneralled.

b. trans. and fig.

1859 J. S. MILL in Fraser's Mag. LX. 767/1 A nation which thinks of nothing but of outwitting and outgeneraling its neighbours. 1910 J. DRISCOLL Ringcraft 14 He was the better boxer and the stronger man, but was outgeneralled during two-thirds of the bout. 1940 W. FAULKNER Hunter iii. ii. 184 At last he outgeneralled himself with his own strategy... even his father admitted that there was nothing else about the farm for him to learn. 1973 WOODHOUSE Bachelors Anonymous x. 128 However confident he may be that he has outgeneralled a woman, a man likes to have reassurance on the point from a knowledgeable third party. 1976 Billings (Montana) Gaz. 26 June 1-B/6 Tanner has played better tennis - little Kirmayr out-generalled him time and again - but always in reserve was his 140 m.p.h. cannonball service.

out-get to out-girth: see OUT-.

out'give, v. [OUT- 18, 14.] a. trans. To outdo in giving, give more than. b. intr. To give out, come to an end. (poetic.)

1693 C. DRYDEN in D.'s Juvenal vii. (1697) 173 The bounteous Play'r out-gave the pinching Lord. 1893 Billings Shorter P. v. xi. 31 And two days ere the year outgave Me laid him low.

'outgiving, vbl. sb. [OUT- 9.] The action or fact of giving out; that which is given out; a. pl. payments, disbursements; b. utterance.

1663 BLAIR Autobiog. ii. (1848) 25 All the disbursements and outgivings to traders. 1865 Morn. Star 20 Jan. The outgivings of some irresponsible editor. 1881 Times 15 Apr. 6/1 This was the burden of all his outgivings before and after inauguration. 1897 Educat. Rev. XIII. 70 To regard that as the last outgiving of political philosophy.

outgiving ('aotgivn), ppl. a. [OUT- 10.] That gives out; open-hearted, generous. Hence outgivingness.

1942 J. LEES-MILNER Spectator Poets (1975) 31 K. as outgiving as ever. 1961 Spectator 26 May 763/2 [Hendard] Behan is still... a talker and singer for talking and singing's own sake, spontaneous and out-giving. 1963 London Mag. Sept. 11 Her face was round and pleasantly fleshed, her eyes cool and outgiving when she was not anguished or perturbed. 1968 Listener 10 Oct. 458/2 She had lost a great deal, I think, of her out-givingness in that way and the novels perhaps reflect this. 1972 Times 3 July 16/7 There can rarely have been such an outgiving man who was less of an extrovert.

†out-'glad, v. Obs. [OUT- 20.] trans. To surpass in gladness; to delight more.

1657 R. LOVEDAY Lett. (1663) 26 You have not a friend hath out-gladded me for your well-being, nor out-wish'd me for the continuance. Ibid. 192 Might I hope the happiness to meet you at London, nothing would be able to out-glad me. † An intrans. outglad has been erroneously inferred from Wych's Fall out glad; cf. OUT- 15 b.

out'glare, v. [OUT- 18.] trans. To surpass or outdo in glare or dazzling effect; to be more glaring or flagrant than.

1648 HERRICK Hesper., Welcome to Sach 11 Whose radiant flame Out-glares the heav'n's Osiris. 1822 SCOTT Pirate xxxi. Were all my former sins doubled, such a villainy would have outglared and outweighed them all. 1837 Blackw. Mag. XI. 1. 329 [She] lavished her money till she out-glared the poorer ranks of the peasage.

out'glitter, v. [OUT- 18.] trans. To surpass in glitter or splendour.

1648 J. BEAUMONT Psyche ii. cxviii. The gracious splendor of this Queen Sweetly outglitters their best fire of Rays. 1664 CORAINE Tragedy of Ovid iv. 1. I must Out-glitter all the Femals of the Province, Or I shall want my will. 1884 SUS. H. WAND in Independent Alm. (N.Y.) 14 You cannot wish the background to outglitter the picture.

out-gloom, -glory, etc.: see OUT-.

out'glow, v. [OUT- 18.] trans. To excel in glowing; to overcome by superior glow.

1877 E. R. CONDER Bas. Faith ix. 399 Capable of dominating every other passion, of outglowing the fire of youth. 1898 T. HARRY Westex Poem 175 My light in thee would out-glow all in others.

out-gnaw, etc.: see OUT-.

'outgo, sb. [OUT- 7.]

1. The fact of going out or that which goes out; spec. outlay, expenditure; opposed to income.

c. 1640 J. SMYTH Lince Berkeley (1883) I. 168 To regulate his out-goes... to order and frugality. 1797 FRANKLIN Ess. Wks. 1846 II. 98 The Indies have not made Spain rich, because her outgoes are greater than her incomes. 1860 EMERSON Cond. Life, Wealth Wks. (Bohn) II. 358 The secret of success lies... in the relation of income to outgo. 1895 SIR W. HARCOURT Sp. 22 May, Grow as the income or the intake may, the outgo and the waste are always greater.

2. The action of going out; efflux, outflow.

1858 W. ARNOT Latus fr. Heaven II. xvii. 142 [ANGER] bursts, in its outgo, all who lie within its reach. 1878 FOSTER Phys. I. iv. (ed. 2) 108 In a system of elastic tubes... the out-go being as easy... as the income. 1882-3 SCHAFF Encycl. Relig. Knowl. I. 33 The spontaneous outgo of the affections.

3. Outward product; issue, outcome.

1870 W. UNWICK tr. Bleek's Inland N. Nat. II. 175 Their scorn was the outgo of the same frivolous mind.

4. Outlet, means of egress.

1869 S. BOWLES Our New West. I. 26 The great Salt Lake of Utah... has no visible outgo, though richly fed from various quarters. 1880 S. S. HILLYER Plumber & Sanit. Ho. 15 A square-pipe trap, with a round outgo.

outgo (aot'gou), v. [OUT- 14, 18, 17.]

†1. intr. To go out, go forth. Obs. except poetic.

In OE. and ME. usually two words, etc. when imitating L. exire; in later use only where modern usage would allow out go in two words as a prosodic inversion of go out.

1825 Vesp. Psalter xviii. [ix.] 5 In alle corran utode swag. 1844-5 Act 10-17 Chap. II. c. 11 §2 The River of Welland from the Outgang at the East end of East Deeping. 1828 Craven Gloss. (ed. 2). Out-gang, a road from a place. 1896 T. BLASHILL Sutton-in-Holtshire 26 An ordinary out-gang was a place where the cattle of a village assembled when they were to be driven out together to graze in common. 1859 J. S. MILL in Fraser's Mag. LX. 767/1 A nation which thinks of nothing but of outwitting and outgeneraling its neighbours. 1910 J. DRISCOLL Ringcraft 14 He was the better boxer and the stronger man, but was outgeneralled during two-thirds of the bout. 1940 W. FAULKNER Hunter iii. ii. 184 At last he outgeneralled himself with his own strategy... even his father admitted that there was nothing else about the farm for him to learn. 1973 WOODHOUSE Bachelors Anonymous x. 128 However confident he may be that he has outgeneralled a woman, a man likes to have reassurance on the point from a knowledgeable third party. 1976 Billings (Montana) Gaz. 26 June 1-B/6 Tanner has played better tennis - little Kirmayr out-generalled him time and again - but always in reserve was his 140 m.p.h. cannonball service. 1693 C. DRYDEN in D.'s Juvenal vii. (1697) 173 The bounteous Play'r out-gave the pinching Lord. 1893 Billings Shorter P. v. xi. 31 And two days ere the year outgave Me laid him low. 1657 R. LOVEDAY Lett. (1663) 26 You have not a friend hath out-gladded me for your well-being, nor out-wish'd me for the continuance. Ibid. 192 Might I hope the happiness to meet you at London, nothing would be able to out-glad me. † An intrans. outglad has been erroneously inferred from Wych's Fall out glad; cf. OUT- 15 b. 1648 HERRICK Hesper., Welcome to Sach 11 Whose radiant flame Out-glars the heav'n's Osiris. 1822 SCOTT Pirate xxxi. Were all my former sins doubled, such a villainy would have outglared and outweighed them all. 1837 Blackw. Mag. XI. 1. 329 [She] lavished her money till she out-glared the poorer ranks of the peasage. 1648 J. BEAUMONT Psyche ii. cxviii. The gracious splendor of this Queen Sweetly outglitters their best fire of Rays. 1664 CORAINE Tragedy of Ovid iv. 1. I must Out-glitter all the Femals of the Province, Or I shall want my will. 1884 SUS. H. WAND in Independent Alm. (N.Y.) 14 You cannot wish the background to outglitter the picture. 1648 J. BEAUMONT Psyche ii. cxviii. The gracious splendor of this Queen Sweetly outglitters their best fire of Rays. 1664 CORAINE Tragedy of Ovid iv. 1. I must Out-glitter all the Femals of the Province, Or I shall want my will. 1884 SUS. H. WAND in Independent Alm. (N.Y.) 14 You cannot wish the background to outglitter the picture. 1648 J. BEAUMONT Psyche ii. cxviii. The gracious splendor of this Queen Sweetly outglitters their best fire of Rays. 1664 CORAINE Tragedy of Ovid iv. 1. I must Out-glitter all the Femals of the Province, Or I shall want my will. 1884 SUS. H. WAND in Independent Alm. (N.Y.) 14 You cannot wish the background to outglitter the picture.

2. trans. To outstrip in going; to go faster than, pass; to outdistance. arch.

1530 PALSCR. 650/2 Though thou be goynge an hour afore me, yet I wyll out go the. 1596 SPENSER F.Q. v. viii. 4 Yet bed the fast; 971 What terror 'tis ' outgo and be outgon. 1678 BUSBY Pilgr. l. 164 Shall we talk further with him? or out-go him at present? 1742 FIELDING Z. Andros ii. 11. It generally happens that he on horseback outgoes him on foot. 1778 Eng. Gazetteer (ed. 2) s.v. Worthington, Horses, which, changing often, travel day and night without intermission, and, as they say, out-go the post.

3. To go beyond (a point, bounds, etc.); to exceed or surpass; to excel, outstrip, outdo.

1553 T. WILSON Rhet. 64 b. Wo be to that realm where might outgoeth right. 1579 SPENSER Sheph. Cal. Apr. 16 His wonted songs, wherein he all outwent. 1627 MILTON Pac. Exerc. 79 In worth and excellence he shall out-go them. 1799 A. HAMILTON Lett. in Washington's Writ. (1893) XIV. 178 note. I do not think it expedient to outgo our supply of clothing. 1885-94 R. BRIDGES Eras & Psyche Sept. xxiii. Such sorrow as outwent The utmost pain of their punishment.

†4. To pass, go through, spend (time). Obs. 1594 SPENSER Amoretti II. One yeare... The which doth longer unto me appeare, Then all those fourty which my life out-went. a 1613 OVENYON A Wife, etc. (1638) 275. I have once in my life out-gone night at Sea.

†5. 'To circumvent, to overreach' (J.). Obs.

